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ABSTRACT

Noting that current theories of comprehension are based on the assumption that cognitive patterns (schemata) are structural constructs and that credit for the structural assumption is generally given to F. C. Bartlett, this paper suggests that problems concerning the phenomenal nature of the patterning aspect of cognition may be more readily resolved at a functional level. It also argues that Bartlett perhaps never meant his schema theory to be one about the structural aspect of cognition and contends that the interpretation of his theory as such is perhaps no more than an oversight on the part of current cognitive scientists. The paper then presents an alternative view of schemata as phenomenally transient functional patterns. (Author/FL)

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THE SCHEMA: A STRUCTURAL OR A FUNCTIONAL PATTERN

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Abstract

Current theories of reading comprehension have been based on the assumption that cognitive patterns (schemata) are structural constructs, and credit for the structural assumption is generally given to Bartlett (1932). In this paper it is suggested that problems concerning the phenomenal nature of the patterning aspect of cognition may be more readily resolved at a functional level. It is also argued that Bartlett perhaps never meant his schema theory to be one about the structural aspect of cognition. The interpretation of his theory as such is perhaps no more than an oversight on the part of current cognitive scientists. An alternative view of schemata as phenomenally transient functional patterns is presented.

The Schema: A Structural or a Functional Pattern

Currently, dominant theories of comprehension and cognition are schema theories. They all assign a central role in comprehension to high-level, domain-specific cognitive structures variously referred to as "frames" (Minsky, 1975), "scripts" (Schank & Abelson, 1977), "schemata" (Rumelhart & Ortony, 1977; Rumelhart, 1978), or "micro/macro-structures" (Kintsch & van Dijk, 1978).

Indubitably, the notion of schema is a useful one. It not only refers to elements and relations in the conceptual network (Ortony, 1978, p. 54), but it also underscores the patterning aspect of cognition (Anderson, 1977). Schemata further draw attention to the domain-specific nature of knowing. More specifically, in contrast with traditional information processing theories that emphasize processing, storage, retrieval, and utilization of knowledge in general, schema-based research concentrates predominantly on knowledge of particular domains.

Domain specificity is clearly a relevant issue. This is because people's cognition and comprehension seem to operate in terms of specific domains and in specific situations. Experimental psychological work based on the notion of schema and related concepts has demonstrated that comprehension of the same textual material varies from one specific domain of knowing (one schema) to another. It makes a real difference whether or not the subjects know that the passage they are about to read is, for instance, about "washing clothes" (e.g., Bransford & Johnson, 1972), whether

they know what they are reading is about eating in a fancy restaurant as opposed to shopping at a supermarket (e.g., Anderson, Spiro, & Anderson, 1977), buying as opposed to burglarizing a home (e.g., Anderson & Pichert, 1978), breaking out of jail as opposed to wrestling (Anderson, Reynolds, Schallert, & Goetz, 1977), or finally, whether they find out later that the female character of the passage they have read is a lesbian as opposed to a heterosexual (Snyder & Uranowitz, 1978). Furthermore, people become experts in specific domains. There are no such things as experts per se. Rather, there are expert tennis players, expert readers, expert problem solvers, expert clinicians, and so forth. It is perhaps this realization which renders the use of nonsense syllables as (domain-independent) experimental material nonsensical. In short, if common denominators concerning cognitive functioning in general are to be discovered, they ought to perhaps be sought where they are actually operative, i.e., in terms of specialized domains of knowing.

Thus, conceptually and essentially, a schema is a domain-specific relational cluster. Beyond this, however, the concept of schema remains, theoretically, disturbingly vague. One reason for this is that the metaphors cognitive scientists use (e.g., "link," "association," "connection," "pointer," etc.) to refer to the relations among schema constituents are purely conceptual. The question of the phenomenal nature of cognitive patterning has not as yet been addressed. In fact, given the current state of the art, the problem of the phenomenal nature of schemata remains a remote issue. The purpose of the present paper is to discuss how cognitive patterning is phenomenally possible.

The term phenomenal is meant to refer to the physical reality of cognitive schemata and to the physical validity of the concepts used in theorizing about them. It is presumed and emphasized that the phenomenal validity of cognitive patterns is as inevitable as it is urgent. That the phenomenal validity of the concepts under investigation is a necessary precondition for scientific discovery is evident from many instances in the history of science. True, the concept of light bulb, for instance, must have been a purely conceptual notion for some (short?) time before the light bulb was actually constructed. This is itself perhaps a necessary precondition. But the usefulness of conceptual metaphors is contingent on the scientist's firm belief in their phenomenal possibility as well as on some "thinkable" basis for the belief. Purely conceptual metaphors with mysterious phenomenal possibility or no phenomenal validity at all are logical shuttles which only serve to delay the thought and investigation. It was Edison's unshakable belief in the phenomenal possibility of the light bulb, and a more or less clear notion about the nature of this possibility, which led to its phenomenal reality, i.e., to the actual construction of the light bulb. Without this final step, the concept would have been worth nothing.

Early in this introduction I stated what I believe schemata are. Before discussing the phenomenal nature of schemata, it must be also clarified what schemata are not. The following section is aimed at this issue.

Unexplaining the Concept of Schema

The Schema as a Structural Construct

For many theorists who use it, the term schema has come to be synonymous with the word structure. The schema-is-a-structure assumption is clearly evident in the cognitive scientific literature and needs no elaboration. What is perhaps not as obvious is what the term structure (schema) is meant to represent. I will attempt to clarify this issue by looking at the metaphors cognitive scientists often use to qualify or describe the notion of schema and by considering the contrast often made between the terms structure and process.

First, schemata are generally claimed to be pre-existing knowledge structures stored in some location in the head. A schema is said to be a collection of concepts and associative links together (e.g., Ortony, 1978, p. 54) or "a cognitive template against which new inputs can be matched and in terms of which they can be comprehended" (Rumelhart & Ortony, 1977, p. 131). Furthermore, like any stored or storable entity, schemata are said to be "searched," "found," "utilized," and "stored again." The following excerpts from some often-cited sources in the literature of cognitive science clearly illustrate this point:

> The reader brings a large repertoire of knowledge structures to the understanding task . . . Rumelhart puts the matter very well when he says, "the process of understanding a passage consists in finding a schema which will account for it." (Schank & Abelson, 1977, p. 10)

> According to "schema theories" all knowledge is packaged into units. These units are the schemata. (Rumelhart, 1978, p. 3)

> The entire memory system contains an enormous number of schemata and memories. At any one time only a few of them are required and no procedure of random search could possibly lead to their efficient discovery. The search for likely candidate schemata must, therefore, be somehow guided and it must be sensitive to the context. . . (Rumelhart & Ortony, 1977, p. 128)

> The building block of the model is the "State of Schema." The SOS is a representation of the subset of the information hypothesized to be stored in a schema (or a set of related schemata). (Spiro, 1977, p. 151)

The above paragraphs clearly reflect a belief that schemata are relatively permanent structures (at least as permanent as the long-term memory), that they are brought to the comprehension situation somewhat ready-made, and that they have a substantive nature (which is as yet unspecified) capable of being stored, searched, retrieved, and so forth. One may also note the passive static character of these cognitive templates, though some theorists might argue otherwise.

That the term structure refers to the relatively permanent, substantive, pre-existent, and static aspect of cognition is evident from the fact that cognitive scientists often contrast it with the term process (see, e.g., Bobrow & Norman, 1975; Collins & Loftus, 1975, pp. 411-413;

Rumelhart & Ortony, 1977, p. 100, pp. 127-128), which may be presumed to point to the more transient and dynamic aspect of cognition. In this sense the term process falls in the same category as the word function.

Bartlett (1932), for instance, contrasts structure with function instead of process. However, for Bartlett, it is live biological structures that function rather than object-like knowledge or mental structures. He finds no necessity in appealing to mental structures in his account of remembering. "Everything in this book," Bartlett states, "has been written from the point of view of a study of the conditions of organic and mental functions, rather than from that of an analysis of mental structure. It was, however, the latter standpoint which developed the traditional principles of association. The confusion of the two is responsible for very much unnecessary difficulty in psychological discussion" (p. 304).

And indeed it is. The slight difference in terminology reflects a fundamental difference in theoretical perspective. The term function as a verb is intransitive. For Bartlett, live biological structures act. They do not act upon some object-like entity. His is not an industrial-plant metaphor. This is why Bartlett can do away with the notion of storage entirely (p. 200). On the contrary, the term process is transitive; it requires an object, i.e., some entity to get processed.

The Schema as an Explanatory Construct

While this paper is centered around the idea that the patterning aspect of cognition must be treated as a problem to be resolved, many theorists have used the schema as an explanatory construct. Schemata are often said

to be "employed in the process of interpreting sensory data, (both linguistic and non-linguistic) in retrieving information from memory, in organizing actions, in determining goals and sub goals, in allocating resources and generally in guiding the flow of processing in the system" (Rumelhart, 1978, p. 2). In short, "theorists have tended to regard schemata as a panacea . . ." (Ortony, 1978, p. 54). Since it is not clear how the concept of schema is capable of performing these "wondrous acts," as Rumelhart calls them, one feels compelled to suggest that the term schema only be used to refer to the purely patterning aspect of cognition and even then as a problem to be resolved. I repeat the question posed early in this paper: Just how is patterning phenomenally possible?

The Structural Assumption and the Problem of Patterning

The Nature of the Problem

The idea that schemata are relatively permanent, pre-existing knowledge structures (cognitive building blocks, cognitive templates, etc.) with constant internal relationships becomes paradoxical when the problem of the phenomenal nature of cognition is considered. This is because one can assert with confidence that there is no single element in the entire cognitive network which can be said to belong, or be uniquely connected to, one and only one schema. It is more likely that element E is a component of schema A at one time and an element of B, C, or D at some other time. But if this is the case, in what sense can it be claimed that E is more an element of A than an element of B, C, or D? In other words, what does it mean to say that elements of A form a structural associative knowledge cluster?

In order to conceptualize the magnitude of the problem, consider the the metaphors often used to refer to knowledge networks. "Encyclopedia," "dictionary," or "thesaurus" are among the most common. Imagine, now, the extent of crisscrossing of associations necessary to represent in structural network form an encyclopedia of everything a particular average college student, for instance, might know. Even if such a representation were possible, a clearly questionable possibility, it would constitute a static representation. Hardly anyone, however, would doubt the idea that the human cognitive network is a highly plastic, highly dynamic network; the relations involved are constantly in a state of change. As Bartlett (1932) states, "since many 'schemata' are built of common materials, the images and words that mark some of their salient features are in constant, but explicable, change" (p. 214). Truely, the number of possible connections and combinations (i.e., schemata) is indefinitely large. As long as purely conceptual metaphors such as "link," "association," "pointer," etc. are used, the problem remains masked. At a phenomenal level a structural cognitive network seems impossible to imagine, if not simply impossible.

It is because of the requirement of "constant change" in the face of constantly novel situations that the idea of schemata as pre-existing structures becomes paradoxical. As Anderson (1977) points out,

> It could not be that people have stored a schema for every conceivable scene, event sequence, and message. . . . Even if the nominal stimuli in two situations were the same, people change. They come to similar situations with different perspectives and different intentions; they

play different roles. It follows that people do not function by selecting the right template from a great mental warehouse of templates abstracted from prior experience. The process must be more dynamic. (p. 421)

Neither can it be said that a schema is a collection of independently linked concepts. In an associative pattern, if the link with one of the elements is missing, the remaining fragment may preserve the pertinent characteristics. It seems more reasonable to assume that a schema is a gestalt. In this sense, combine might be a better metaphor than link or associate. The whole is more than the collection of its elements. If oxygen is taken out of water, the property of "waterness" is lost, because this property is not independently present in the components. Similarly, if an element of a cognitive pattern is taken out or replaced by another element, the resulting combination gives rise to a different pattern with its unique properties. "Opening a door" is not the same as "opening a bottle," "opening one's mouth," "opening a discussion," or "opening a can of worms" (see Anderson & Ortony, 1975; Goetz, Anderson, & Schallert, 1979). If Wittgenstein is right, words like "open," "game," etc. do not depend on a common underlying structure whether it be called "a core meaning," "a schema," or something else.

The Relationship Between the Neuronal Network and the Cognitive (Conceptual) Network

Sooner or later, theories of cognition will have to deal with the

problem of the relationship between the neuronal network and the conceptual network. However, given the structural assumption and the overly complicated picture of the conceptual network it provides, the issue seems as remote as the related problem of phenomenal nature of patterning. This is perhaps why some ingenious attempts at building psychoneurological models, as made by Hebb (1949), have remained largely ignored.

Some cognitive scientists, however, have demonstrated a willingness to speak in neurological terms. Collins and Loftus (1975), for instance, consider their semantic network model quasi-neurological (p. 411). This is perhaps because they use neuronal terms such as "activation," "threshold," and "summation" in the context of their structural conceptual network. A cogent summary of their model is given in the following paragraph from Ortony (1978).

> In their recent modification and improvement of the Quillian (1968) network model of semantic memory, Collins and Loftus (1975) introduce some additional processing assumptions. The first is that when a concept is processed activation spreads from it in a decreasing gradient; the second is that release of activation from a concept continues at least as long as that concept is processed; and a third relates to decrease of activation over time. The fourth addition is that activation from different sources summate and that there is a threshold which determines whether or not an intersection is found. Added to these are two additional structural features. First, that semantic similarity plays a larger role in the organization of the

network, and second that the names of concept, i.e., words, are stored in a lexical network, which is to some extent independently "primable." (p. 55)

Quasi-neurological semantic network models, therefore, speak of activation spreading in a structural conceptual network. However, it is possible that cognition can be characterized without the need to hypothesize such associationistic networks. As Bartlett (1932) suggests, this would also eliminate a great deal of "unnecessary difficulty in psychological discussion" (p. 304). Whatever the case may be, the relationship between the neuronal and the conceptual networks must be theoretically clarified before neurological concepts can be used in the psychological domain.

Toward a Solution to the Problem of the Phenomenal Nature of Cognitive Patterning

The Schema as a Functional Construct

Underlying cognitive patterns, according to the structural assumption discussed above, are relatively permanent, frame-like, knowledge structures with constant internal connections. Counter-intuitive as it may at first seem, it is entirely conceivable, however, that, phenomenally, the patterning aspect of cognition is a functional rather than a structural organization. The question of the phenomenal nature of cognitive clusters may be posed in the following manner: Given schemata A and B which share elements (e.g., the schema for "super-market" and the schema for "restaurant"), is it the case that when A is in a state of functioning (activation) B is also preserved (stored?) in some intact structural form?

A structural assumption, it seems, is committed to a positive answer to the above question. In fact, schema theorists assert that even in cases where the same generic schemata are used in comprehension of a particular passage, that is, in schema-theoretic terms, an instantiated copy of them is constructed, "what gets stored in memory is, in effect, a copy or partial copy of these instantiated schemata" (Rumelhart & Ortony, 1977, p. 116).

By contrast, if it is assumed that the frame-like aspect of cognition is a functional phenomenon, the need does not arise for preservation of multiple copies. Furthermore, there will be no need for hypothesizing an independent frame-like structure corresponding to each and every independent functional pattern. The following section is intended to elaborate on these ideas.

An Analogy

In order to clarify the functional-structural distinction, I will use what I will hereafter refer to as the light-constellation analogy. The problem is how to conceptualize a phenomenally possible system which would generate functional patterns not necessarily based on independent frame-like structural entities. Imagine a room containing a few hundred lights, each having a different shade of color. Now in this simple constellation, every time a subset of the lights goes on, it generates a unique but phenomenally transient functional pattern. Here phenomenal means some not-purely-conceptual entity such as physical energy; transient means when the lights go off the pattern no longer exists in its frame-like form; and functional means some kind of apparatus functions and this leads to some product

(light). Now, when a given cluster of lights goes off, some of its component lights can participate in some other cluster to generate another unique pattern. Thus, between two patterns that share elements, when one is functional the other is non-existent and vice versa.

If, on the other hand, one assumes that the cluster-like characteristic of the system is structurally-based, the only way that the system could be phenomenally possible would be by constructing a new light cluster for each new observed pattern. This would mean, of course, that multiple copies of the same structural entities (lights) would be required which would, in turn, require storage and working space accommodation for an infinite number of structural patterns.

The light-constellation analogy is deceptively simple. Even at the elementary level outlined above, it has tremendous explanatory power. First, it clearly illustrates how an infinite number of unique functional patterns could be generated based on a limited number of structural elements. Secondly, there is no need for an independent storage mechanism. Thirdly, for each functional pattern, the unique functional characteristic of the whole is clearly greater than (or rather different from) that of the individual component parts: the shade of color generated by a given subset cluster will be different from that generated by individual lights. And, most importantly, there will be no need for an independent structural pattern corresponding to each distinguishable functional pattern.

However, a functional assumption need not imply that there is necessarily no independent structural basis underlying a given functional

pattern. All it says, I reiterate, is that there is no independent frame-like structural entity corresponding to each distinguishable cognitive pattern. It is conceivable, for instance, that for a given cluster, a single element would be structurally available to signal, when activated, functioning within the entire cluster. Inversely, a single element could also be structurally available to function (get activated) in response to the functioning of a particular cluster. Such single elements could provide one way for the system to keep record of past functional patterns. For instance, a single element specialized to respond to a particular functional pattern (A) could, in turn, signal activation of a second functional pattern (B) generating, "Oh, yes! This is old. I recognize it." And this could, in principle, happen every time A got activated.

Cognition as a Functional Phenomenon

The structural-functional distinction may be further clarified by considering two distinct meanings of the term cognition. The first meaning could be represented by such terms as "perceiving," "knowing," "understanding," "remembering," and so on. The second meaning would refer to the products of such acts. The product of the act of knowing, for instance, is knowledge. The functional approach would be directly concerned with the first meaning: What sort of live biological elements (analogous to the lights in our constellation apparatus) give rise to these acts? How do the elements relate? What causes the initiation and cessation of functioning in the elements (the turning on and the turning off of the lights)? How, when, and why do new elements enter the scene? The

functional approach assumes that patterning "is created" by the neuronal elements functioning in unison. When functioning of a set of elements ceases or when the elements participate in some other pattern, the previous pattern is no longer in existence; though it can, of course, be recreated. In short, based on the functional assumption, the cognitive (conceptual) network is a functional network and as such the network as a whole remains an abstraction--only portions of it can be said to phenomenally exist at different times but never the network as a whole.

The structural approach, on the other hand, is a product-centered approach. It raises a different set of questions: How is knowledge processed, retrieved, and stored? How is it organized? And so forth.

I used a light-constellation analogy to demonstrate how unique patterns may emerge. The analogy may be extended, for the sake of comparison, to encompass the structural assumption. What is needed is a camera to take a picture of each unique pattern which is generated. Only then the need would arise for a storehouse for the pictures; and only then one may speak of searching, finding, retrieving and so on. The organization of the pictures in the storehouse would then create a problem; and only then one might speak of copies and originals or tokens and types.

The constellation analogy, without necessarily suggesting inherent correspondence with the human cognitive system, demonstrates how a highly generative phenomenal system is possible. It does this without necessarily appealing to such independent conceptual constructs as "code," "memory," "storage," etc. (so reminiscent of faculty psychology) or "link," "token,"

"pointer" "similarity," "comparison," etc. (which are deep-seated remnants of associationism). I consider this a major advantage of the functional approach. Bartlett (1932) argued against both of these traditions and pointed out that "the force of the rejection of associationism depends mainly upon the adoption of a functional point of view . . ." (pp. 307-308). Bartlett also prophetically stated:

> In various senses, therefore, associationism is likely to remain, though its outlook is foreign to the demands of modern psychological science. It tells us something about the characteristics of associated details, when they are associated, but it explains nothing whatever of the activity of the conditions by which they are brought together. (p. 308)

Bartlett used the term "remembering" to emphasize the functional aspect of the influence of the past on the present. Unfortunately, with few exceptions (e.g., Bransford, McCarrell, Franks, & Nitsch, 1977), Bartlett has been generally misunderstood (see below). This is perhaps due to the deep-seated influence of conceptual (as opposed to phenomenal) metaphors such as the above (e.g., memory). It may still take many direct and ingenious attacks like that of Bransford et al. to unexplain these metaphors and many years before they are annihilated, roots and all.

The functional approach, using the light constellation analogy, provides an alternative conceptualization of the human cognitive capacities. It demonstrates that a lot of these "faculties" are no more than different aspects of the same mechanism.

However, the application of the light-constellation analogy may strike some readers as too mechanistic to be meaningful with respect to the human cognitive system. Admittedly, this feeling is somewhat justified. Clearly, metaphors present both desirable and undesirable aspects. Therefore, caution must be exercised in their use and interpretation. In the present paper, the analogy was introduced to allow a clearer conceptualization of how "patterning" is possible as a functional phenomenon. To the extent that it has served this purpose, the analogy has been successful. It must also be noted, on the other hand, that the metaphor can also safely permit an overall picture of the cognitive system in a most revealing fashion. Whether or not it will develop into a mechanistic perspective will largely depend on the details that will have to be filled in. We are told that the "pump" metaphor helped physiologists to conceptualize the functioning of the blood circulation system. It can be seen now that the metaphor did not reduce the latter, an amazingly flexible and complex system, to the status of the former, a highly rigid mechanistic apparatus.

Historical Overview

It is fashionable among current cognitive scientists to credit Bartlett (1932) for the notion of schema as a structural construct. The following illustrative excerpts were chosen to reiterate what may be obvious to many readers:

> A central theme in work of the kind referenced above is the postulation of interacting knowledge structures which . . . we shall call

"schemata." The term finds its way into modern psychology from the writings of Bartlett (1932) and it is to him that most workers acknowledge their debt (Rumelhart & Ortony, 1977, p. 100).

> He [Bartlett] hypothesized that to-be-remembered (TBR) information is assimilated into pre-existing holistic cognitive structures (schemata) in such a manner as to lose particular identity. (Spiro, 1975, p. 4; italics added)

> Building upon Bartlett's (1932) original work . . . several story grammars have been constructed to describe the structural basis of story understanding. . . . The theoretical assumptions of these grammars specify that memory for stories is a constructive process, resulting from the interaction between incoming information and pre-existing cognitive structures, or schemata, containing knowledge about the generic characteristics of stories. (Stein & Nezworski, 1978, p. 2)

I believe it is worth considering just how representative of Bartlett's work this current trend in cognitive science is. The following quotations should provide a clue:

> Schemata are data structures for representing the generic concepts stored in memory. (Rumelhart & Ortony, 1977, p. 101; italics added)

> What is stored, given that reconstruction must be based upon some stored information? Some details from discourse are specifically stored. . . . (Spiro, 1977, p. 157; italics added)

I suspect that Bartlett would have greatly disliked to see such metaphors as "stored," "memory," etc. used in reference to his theory. In fact he washed his hands of them when he objected to Head's (1920) use of these concepts in the following fashion:

> . . . Head gives away far too much to earlier investigators when he speaks of the cortex as a "storehouse of past impressions." . . . A storehouse is a place where things are put in the hope that they may be found again when they are wanted exactly as they were when first stored away. The schemata are, we are told, living, constantly developing, affected by every bit of incoming sensational experience of a given kind. The storehouse notion is as far removed from this as it well could be. (p. 200)

My objection to conceptual metaphors of schema theorists may strike the reader as an insignificant point. However, I agree with the suggestion implied by Bransford et al. (1977) that the nature of conceptual metaphors used is an issue of utmost importance in scientific exposition. A scientist's use of concepts represents the way she/he perceives the world. It is the difference between "seeing" the apple fall and "seeing" the earth attract the apple. The first is a routine incident of no significance. The second is a scientific discovery. A scientist's use of concepts could also

represent the degree of accuracy he or she exercises in scientific expositions.

What I would judge to be inaccurate language and/or faulty perspective is also evident in the interpretation of Bartlett's idea of schema reconstruction. Here is an example from Spiro (1979):

> . . . What has already been read is not remembered as it was originally understood; rather, inferences about what must have transpired are made from what is known about later developments. A parallel may be drawn with the activities of a paleontologist who inferentially reconstructs a dinosaur utilizing an assortment of bone fragments (bits of stories) and knowledge about the anatomy and physiology of other dinosaurs (prototypic knowledge about the situations described in a given story). See Bartlett (1932) for further discussion of the reconstruction notion. (p. 5)

Spiro's concept of reconstruction is much closer to the literal meaning of the term than to Bartlett's notion of reconstruction. For Spiro, bone fragments are needed because "reconstruction must be based on some stored information." The light-constellation analogy showed that this is not necessarily the case. Elements participating in reconstruction are active in themselves. For Bartlett, reconstruction begins with an attitude, a momentary setting directed toward a schematic orientation. Bartlett states, "As I have shown, to serve the needs of biological adaptation interests are all the while increasing in diversity, in narrowness and in definiteness.

So our range of search, when we have to attempt recall, tends to get more and more refined" (pp. 312-313). Thus, for Bartlett, reconstruction is a live biological function. The notion of dead dinosaur "bone fragments" is as far removed from this as it can be. In fact, Bartlett disliked the term schema fearing that it might lead to the very same type of interpretation. He states:

> . . . I strongly dislike the term "schema." It is at once too definite and too sketchy. The word is already widely used in controversial psychological writing to refer generally to any rather vaguely outlined theory. It suggests some persistent, but fragmentary, "form of arrangement," [italics added] and it does not indicate what is very essential to the whole notion, that the organized mass results of past changes of position and posture are actively doing [italics in original] something all the time; are so to speak, carried along with us, complete, though developing, from moment to moment. Yet it is certainly very difficult to think of any better single descriptive word to cover the facts involved. It would probably be best to speak of "active, developing patterns"; but the word "pattern," too, being now very widely and variously employed, has its own difficulties. . . . (pp. 200-201)

I suspect that what Bartlett actually meant by the term schema is what has been called elsewhere (Note 1) the "schema-of-the-moment." The term accurately denotes the transient functional aspect of cognitive clustering.

However, the word transient need not indicate fleeting, momentary reactions isolated from the past and the future. On the contrary, the schema-of-the-moment is ordinarily very stable. It lasts, as Bartlett puts it, as long as it is actively doing something. It inherits the influence of "past functioning" en masse and cumulatively, the latter still being functional, and builds upon it from moment to moment.

Thus the distance between Bartlett's concept of schema and that of the current cognitive scientist, is vast indeed. This became evident to me quite by chance when I began to draw excerpts from the literature bearing on the notion of schemata as structural constructs for the purpose of citing in this paper. Surprisingly, in a close reading of Bartlett's discussion of the notion of schema (pp. 186-238, 301-313), I failed to locate a paragraph which would confidently suggest that Bartlett meant schemata to be structural constructs. On the contrary, I found plenty of evidence suggesting that Bartlett's concept of schema may very well have been a functional one. These paragraphs are cited as examples:

> If Head is right, "schemata" are built up chronologically. Every incoming change contributes its part to the total "schema" of the moment in the order in which it occurs. That is to say, when we have movements a, b, c, d, in this order, our "plastic postural model" of ourselves at the moment d is made depends, not merely upon the direction, extent and intensity of a, b, c, d, but also upon the chronological order in which they have occurred. Suppose, for the moment, that a "model," to continue to use this picturesque

> phraseology, is completed, and all that is needed is its maintenance. Since its nature is not that of a passive framework, or patchwork, but of an activity, it can be maintained only if something is being done all the time. So in order to maintain the "schema" as it is--though this is rather inaccurate language--a, b, c, d must continue to be done, and must continue to be done in the same order. (p. 203)
>
> There is, however, an obvious objection to all this. So far as the "schema" is directly responsible for the attitude, it looks as if the latter must itself be predominantly determined by the last incoming incident of the mass of past reactions. But remembering often pretends to be of an incident remote in time, and that incident is not, as in the rote recapitulation method, now reconstructed by going through a whole chronological series in order. If "schemata" are to be reconstructed after the fashion that seems to be demanded by the phenomena of recall, somehow we have to find a way of individualizing some of the characteristics of the total functioning mass of the moment. (p. 208)

It is important to note that Bartlett makes no pretense about knowing how this functional mass of the moment comes about. More specifically, unlike many current cognitive scientists who take the patterning aspect of cognition for granted, Bartlett sees it as a problem to be solved. "Again I wish I knew precisely," he points out, "how it is brought about and again I can make only a few tentative suggestions" (p. 209). And the latter are along the following lines:

> In the clearest and most definitely articulated cases, there first occurs the arousal of an attitude, an orientation, an interest. Then specific detail, either in image or in direct word form, tends to be set up. Finally there is a construction of other detail in such a way as to provide a rational, or satisfactory setting for the attitude. (pp. 304-305)

One possible way to describe, metaphorically of course, how the construction phenomenon may happen is to use the light-constellation terminology. Then one can imagine that (under the influence of Bartlett's prerequisite orientation arousal) some "lights" go on, some gain in brightness, some go off, and still others gain in dimness. The final product is a more or less coherent mass of the moment.

Bartlett emphasizes, and here I adopt Anderson's (1977) chemistry analogy, that in addition to the composition aspect, there is yet a second fundamental aspect, i.e., decomposition:

> If any marked further advance is to be achieved, man must learn how to resolve the "scheme" into elements and how to transcend the original order of occurrence of these elements. This he does, for he learns how to utilize the constituents of his own "schemes," instead of being determined to action by the "schemes" themselves, functioning as unbroken units. He finds how to "turn round his own schemata. . . . (Bartlett, 1932, p. 301)

The "decomposition" aspect of Bartlett's theory has not been appreciated by researchers who have found the phrase "turning round upon one's schema" unclear (e.g., Oldfield & Zangwill, 1942-1943). The problem, we suspect, has arisen not because of some inherent vagueness in Bartlett's theory, but because of researchers' failure to comprehend his functional approach. In functional terms, since relations are assumed to be phenomenally transient, composition and decomposition become relatively easier to conceptualize.

In order for the reader to get an intuitive feeling for the type of functional reorganization discussed above, I will present here a summary of one of the passages which I have used in my experiments concerning this intriguing phenomenon. As the reader goes through the summary, we suggest she/he keep the light-constellation analogy in mind. True, at this level of complexity the analogy is rather unrealistic and could be misleading. Nevertheless, I believe it does provide the intended general framework with the reader filling in any necessary details her/himself.

The story, adopted from Thurmond (1978), is about a nurse, called Marilyn, who leaves the hospital where she works to go home after a late-night shift. The hospital is presumably in the downtown of a large city. When on the freeway, she notices that she is running out of gas and becomes terrified. She remembers the recent surge in muggings, beatings, and so on in the area. Finally, she decides to go to Gabriel's gas station for gas. Gabriel has always seemed to her to be a pleasant person and she knows him by going to his station for gas.

Gabriel fills the tank, returns the change from the twenty, and, as she is ready to leave, he suddenly asks her to go inside the station office with him to see some birthday present he has recently received. Marilyn refuses, but Gabriel insists. She finally agrees. She parks the car out of the way at his request in front of the office window and follows him inside the office.

Once inside, Gabriel quickly locks the door and pulls a gun out of the drawer. She becomes terrified and begins experiencing the symptoms of shock. She sees Gabriel walking toward her. His lips are moving but she cannot hear. She cannot defend herself and she yields to the pressure of Gariel's hand on her shoulder forcing her to the floor. Gabriel is still looking out of the window with the gun clutched in his hand.

Finally, she begins to hear what he is saying: " . . . Sorry I had to scare you like that. I was scared myself when I saw that dude on the floor in the back of your car. . . ."

There are perhaps many different ways to describe the somewhat instantaneous reshuffling involved in the comprehension of this story. But, I believe, the present functional approach presents the most straightforward description.

Summary and Conclusions

Many psychologists would agree that patterning is a fact of cognition. But the phenomenal nature of patterning presents a difficult problem. This is because, in order to avoid postulating multiple copies of the same cognitive elements, patterns must share elements. As Bartlett put it:

> This complexity of "schematic" formulation means that many objects, many stimuli, many reactions, get organized simultaneously into different "schemes," so that when they recur, as, in the world we know they are bound to do, they tend to set into activity various cross-streams of organizing influence. (p. 302)

But sharing elements means breaking the relations in the pattern. One way to solve this problem, and it may be the only way, is to postulate transient relations. And one type of transient relation, and again this may be the only type, is the functional relation of the sort described in this paper. Those who agree with these statements would also note that structural theories of cognition and comprehension are likely to run into unresolvable problems of organization when, and if, they come to deal with the issue of the phenomenal nature of cognitive patterning.

Some readers may argue that we are still far from dealing with the phenomenal nature of cognition and that there are more immediate problems to be resolved and more sophisticated techniques to be developed. This type of argument I consider procrastination in the face of a difficult problem rather than scientific logic. Means develop in response to needs; and it is unlikely that one gets closer to a problem by simply avoiding it.

Unfortunately much psychological theory and research has been based on a great amount of tolerance for vagueness. At the risk of repetition, I will present the following paragraph, part of which was quoted earlier. It is a clear but by no means an isolated example of vagueness:

> For all of the authors mentioned above, schemata truly are the building blocks of cognition [italics in original]. They are the fundamental elements upon which all information processing depends. Schemata are employed in the process of interpreting sensory data, (both linguistic and nonlinguistic) in retrieving information from memory, in organizing actions, in determining goals and sub goals, in allocating resources and generally in guiding the flow of processing in the system. Clearly, any device capable of all these wondrous things must be powerful indeed. Moreover, since our understanding of none of these tasks which schemata are supposed to carry out has reached maturity, it is little wonder that a definitive explication of schemata does not yet exist and that skeptics view theories based on them with some suspicion [italics added]. (Rumelhart, 1978, p. 2)

The tolerance for vagueness characteristic of much psychological literature is only partially justified by the difficulty of the problem. One thing is certain: tolerance for vagueness is detrimental to progress.

I have argued that cognition is a functional phenomenon directly created by the neuronal network. Based on this perspective, there is no need to hypothesize a structural organization other than the neuronal organization. Does this mean that in order to learn about cognition, one would have to open the head and directly examine the neuronal organization? Not necessarily. Obviously, inferences concerning the neuronal network, its organization, and how it functions to create cognitive acts such as perceiving, knowing, remembering, comprehending, thinking, and so on may be

made based on observable products of these functions (e.g., linguistic performance).

Viewing cognition as a functional rather than a structural phenomenon raises some fundamental questions. With respect to research on reading comprehension, for instance, at least two approaches are possible: (a) concentrating exclusively on the analysis of text which corresponds to the functional organization based on the present perspective or to the structural knowledge organization based on traditional cognitive scientific view, and (b) aiming at a characterization of a functionally explicit neuronal system as a structural basis for cognitive functioning. Text grammarians currently do the former. There are serious problems with such an approach. First, as we saw earlier, there is no limit on the possible number of functional patterns. Secondly, even if common denominators were to be found, as one hopes they would be, they may not map the characteristics of the system which should be of ultimate concern. Analyzing the features of the pictures a camera takes may never tell anything about what the camera itself is like. Text and story grammarians need to seriously consider these problems.

Reference Note

1. Iran-Nejad, A. P. *The interface between top-down and bottom-up cognitive functioning: A schema-of-the-moment approach to reading comprehension*. Unpublished manuscript, University of Illinois, 1979.

References

Anderson, R. C. The notion of schemata and educational enterprise: General discussion of the conference. In R. C. Anderson, R. J. Spiro, & W. E. Montague (Eds.), Schooling and the acquisition of knowledge. Hillsdale, N.J.: Erlbaum, 1977.

Anderson, R. C., & Ortony, A. On putting apples into bottles: A problem of polysemy. Cognitive Psychology, 1975, 7, 167-180.

Anderson, R. C., & Pichert, J. W. Recall of previously unrecallable information following a shift in perspective. Journal of Verbal Learning and Verbal Behavior, 1978, 17, 1-12.

Anderson, R. C., Reynolds, R. E., Schallert, D. L., & Goetz, E. G. Frameworks for comprehending discourse. American Educational Research Journal, 1977, 14, 367-381.

Anderson, R. C., Spiro, R. J., & Anderson, M. C. Schemata as scaffolding for the representation of information in connected discourse (Tech. Rep. No. 24). Urbana: University of Illinois, Center for the Study of Reading, March 1977. (ERIC Document Reproduction Service No. ED 136 236)

Bartlett, F. C. Remembering: A study in experimental and social psychology. Cambridge, England: Cambridge University Press, 1932.

Bobrow, D. G., & Norman, D. A. Some principles of memory schemata. In D. G. Bobrow & A. M. Collins (Eds.), Representation and understanding: Studies in cognitive science. New York: Academic Press, 1975.

Bransford, J. D., & Johnson, M. K. Contextual prerequisites for understanding. Journal of Verbal Learning and Verbal Behavior, 1972, 11, 717-726.

Bransford, J. D., McCarrell, N. S., Franks, J. J., & Nitsch, K. E. Toward unexplaining memory. In R. E. Shaw & J. D. Bransford (Eds.), Percieving, acting and knowing: Toward an ecological psychology. Hillsdale, N.J.: Erlbaum, 1977.

Collins, A. M., & Loftus, E. F. A spreading activation theory of semantic processing. Psychological Review, 1975, 82, 407-428.

Goetz, E. T., Anderson, R. C., & Schallert, D. L. The representation of sentences in memory (Tech. Rep. No. 144). Urbana: University of Illinois, Center for the Study of Reading, September 1979.

Head, H. Studies in neurology. London: Oxford University Press, 1920.

Hebb, D. O. The organization of behavior. New York: Wiley, 1949.

Kintsch, W., & van Dijk, T. A. Toward a model of text comprehension and production. Psychological Review, 1978, 85, 363-394.

Minsky, M. A framework for representing knowledge. In P H. Winston (Ed.), The psychology of computer vision. New York: McGraw-Hill, 1975.

Oldfield, R. C., & Zangwill, O. L. Head's concept of the schema and its application in contemporary British Psychology. British Journal of Psychology, 1942-1943, 32, 267-286; 33, 58-64, 113-129, 143-149.

Ortony, A. Remembering, understanding, and representation. Cognitive Science, 1978, 2, 53-69.

Quillian, M. R. Semantic memory. In M. Minsky (Ed.), Semantic information processing. Cambridge, Mass.: M.I.T. Press, 1968.

Rumelhart, D. E. Schemata: The building blocks of cognition (CHIP Rep. No. 79). La Jolla: University of California, Center for Human Information Processing, December 1978.

Rumelhart, D. E., & Ortony, A. The representation of knowledge in memory. In R. C. Anderson, R. J. Spiro, & W. E. Montague (Eds.), Schooling and the acquisition of knowledge. Hillsdale, N.J.: Erlbaum, 1977.

Schank, R., & Abelson, R. Scripts, plans, goals, and understanding. Hillsdale, N.J.: Erlbaum, 1977.

Snyder, M., & Uranowitz, S. W. Reconstructing the past: Some cognitive consequences of person perception. Journal of Personality and Social Psychology, 1978, 36, 941-950.

Spiro, R. J. Inferential reconstruction in memory for connected discourse (Tech. Rep. No. 2). Urbana: University of Illinois, Laboratory for Cognitive Studies in Education, October 1975. (ERIC Document Reproduction Service No. ED 134 927)

Spiro, R. J. Remembering information from text: The 'state of schema' approach. In R. C. Anderson, R. J. Spiro, & W. E. Montague (Eds.), Schooling and the acquisition of knowledge. Hillsdale, N.J.: Erlbaum, 1977.

Spiro, R. J. Prior knowledge and story processing: Integration, selection, and variation (Tech. Rep. No. 138). Urbana: University of Illinois, Center for the Study of Reading, August 1979.

Stein, N. L., & Nezworski, T. The effects of organization and instructional set on memory (Tech. Rep. No. 68). Urbana: University of Illinois, Center for the Study of Reading, January 1978. (ERIC Document Reproduction Service No. 149 327)

Thurmond, P. J. If cornered, scream. Ellery Queen's Mystery Magazine, January 1978, 66-68.

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